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Address

ON

SOME RELATIONSHIPS OF INDIGESTION

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BY

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SOME RELATIONSHIPS OF INDIGESTION.

GENTLEMEN,—In the living organism with its complexity of structure and intimate interaction of functional manifestations it is difficult, if not impossible, to conceive that when disease is established in one tissue or organ, however localised and however slight in degree, it can continue without producing some effect—some perversion both of structure and function in adjacent and associated parts. A morbid condition, in short, occurring in any region becomes thereby a disturbing factor in the environment of the surrounding area in which it tends to determine a secondary complication. The nature and severity of this latter will depend in great part upon the nature and extent of the primary disease as well as on the relationship, structural and functional, that may exist between the original seat of the mischief and the part secondarily involved. I have ventured to think that I might not unprofitably employ the hour that the courtesy of your committee has placed at my disposal in bringing before you some of the relationships which perversions of the digestive function bear to the organism as a whole, not only as regards the various precedent or causal conditions of such perversions, but also the disturbances which they in turn give rise to in parts remote from those primarily at fault. It appears to me that considerations such as these are essential to the proper understanding of the protean symptoms of dyspepsia, and for want of them, or of others similar, much confusion exists in the intelligent observance of the manifestations of indigestion and in their systematic investigation, as well as in formulating a rational and successful plan of treatment in place of the empirical and haphazard therapeutics which so largely prevail in this department of practical medicine.

The digestive organs, strictly speaking, are those concerned with the preparation of the ingesta, both solid and liquid, in such manner as may fit them for absorption into the blood current either directly or *viâ* the lymphatic channels. They consist of a canal many feet in length, suitably provided with means for the sub-division, mixing, and propulsion of the contents ; and associated glands, some of which are in the thickness of the walls of the canal, others—as liver, pancreas, and salivary glands—at some distance from the tube, with which they communicate by ducts. Structurally the tract consists of a lining of mucous membrane, the epithelium of which presents the microscopic characters—spheroidal, columnar, and squamous—associated with glandular, absorbent, and merely protective functions. External to this membrane, in which the blood and lymph capillaries are disposed for the most part in a meshwork of adenoid tissue, is an arrangement of contractile muscular tissue so arranged as to effect the complex movements of mastication, deglutition, and gastro-intestinal peristalsis. The entire serous coat of the stomach and intestines takes no part that I am aware of in the digestive process proper. Genetically the epithelium of the canal with its associated glands, except that lining the cavity of the mouth, is derived from the hypoblast, whilst the connective tissue, muscular and serous coats with the bloodvessels and lymphatics are developed from the mesoblast, as the nerves are epiblastic in origin. The process of digestion—i.e., the reduction of the food to a diffusible state—is effected by the chemical agencies of certain acid and alkaline secretions, together with the ferment action of bodies whose nature is very imperfectly known, such as ptyalin, pepsin, trypsin ; and supplementary to these changes, but as shown to be by no means essential to efficient digestion, are various disintegrations and decompositions brought about—at least in the intestinal contents—by the action of micro-organisms which have obtained entrance with the food and air that have been swallowed. Although carried out in different sections of the alimentary canal under the all-important influence of the body heat, the function of digestion is, to all intents so far as the actual body tissues are concerned, performed outside the body, and in respect to many articles of food is a continuation of the preliminary changes effected in the course of cooking. I have no need to enter into a detailed account of the specific action of the several digestive secretions which differ among themselves in the conditions needful for their activity, in the rapidity with which they produce their results, and in their relative importance to the efficient performance of the function.

But there are several considerations of a general character upon which stress must be laid. It is all-important to remember that these secretions act upon the ingesta successively—that is, each one not only effects certain changes in one or more of the alimentary principles, rendering it more or less diffusible, but also determines other changes which are needful to the efficient action of the secretions which subsequently mingle with the food. Carried out in a progressive series of stages, each stage is marked by its own specific share in the process of digestion, and each contributes in some degree to the proper performance of those which follow. Disturbance of one, therefore, not only produces a direct effect, but indirectly affects those which come after.

A circumstance which confers a distinctive peculiarity upon the digestive function and characterises in no small degree its imperfection, is that there are special organs subject to the same kinds of structural disease as are other parts of the body, and there is also, to some extent independent of these organs, a material undergoing complex chemical changes. It is the existence of these two factors—organs and material—which has to be recognised in all questions connected with digestion, and to a certain degree to be considered separately as well as in combination. Comparison with the other nutritive functions shows nothing such as obtains in digestion. In respiration, e.g., noxious gases may be inhaled, but none are formed in the lungs; though poisonous bodies may be excreted by the kidneys they are not absorbed by those organs, and the same is probably true as regards the skin.

It is well with the purpose we have in view clearly to limit our conception of digestion to the conversion of the ingesta into a diffusible state. The further process by which the digesta are absorbed, intimately associated as it is with digestion proper on the one hand and with the circulation of the blood and lymph on the other, is nevertheless a different function and is carried out in its own peculiar way. And it is also desirable not to allow the nutritious character of the food taken to be confounded with its digestibility. The two qualities are not co-terminous. Many exceedingly nutritious—i.e., of value in the production of tissue or energy in the economy—substances require much digestion, whilst others demanding but a minimum of change to allow of their absorption may nevertheless be most harmful. How far in the course of the true digestive process the various aliments, in addition to those modifications in construction which render them diffusible, also enter on the path of those requisite alterations (anabolic or synthetic) which fit them

ultimately for protoplasmic formation, having regard to the reconversion of some of the absorbed products to the form in which they were originally submitted to digestion, is a question that cannot be entered on here ; but it would seem likely that some of these constructive changes do take place in the intestinal mucous membrane, and still more probably in the liver. Under healthy circumstances the successive stages of this complicated function are performed—except so far as the ingestion, mastication, and deglutition of the food and the evacuation of the egesta are concerned—without giving rise to any conscious sensation. But this state of health assumes a suitable dietary, a structural integrity of the organs concerned, an adequate vascular supply, and a normal nervous control. Improprieties or disturbances of one or other of these fundamental conditions determine imperfections in the digestive process, severe or slight, lasting or transient, and establish indigestion or dyspepsia.

In the whole category of terms used in the description of diseased states it may be safely affirmed that none are employed with less precision than are these synonyms. Scarcely two persons, lay or professional, attach to them the same meaning, and the conditions they are supposed to denote are the most diverse. This unfortunate vagueness of language commonly expresses a corresponding vagueness of idea, and a subject that is intrinsically difficult and uncertain is made more so by this lack of exactness in language. It is difficult, no doubt, to be precise in the use of words the full significance of which is frequently changing with advances in knowledge or an altered point of view ; but some attempt at consistency should be made and some common agreement arrived at which should prevent one authority applying the words to the failure in the digestive process restricted perhaps to one particular phase, and another of equal weight implying by them the symptoms which such failure may give rise to. Much of the difficulty would be removed by a preliminary definition of terms and a consistent use of them in the sense defined. I mean by indigestion or dyspepsia some perversion of the function of digestion, wherever in the alimentary canal, whether mouth, stomach, or intestines, this may take place, whatever may have been its cause, and whatever may be its symptoms. Though referring to perverted function I none the less conceive it as determined either immediately or remotely by some alteration in structure, be that alteration of a gross character or one requiring a microscope for its detection, or still further some abnormality in the "chemical structure" of the tissues concerned. Inasmuch as the

first object of clinical investigation is to ascertain "what is wrong" and "how it is wrong" before attempting treatment, we regard the morbid signs and symptoms present in any case as the evidence upon which our opinion is based, and the more accurately we obtain the evidence the more correct is likely to be our final judgment. Clearly, then, the numerous and diverse symptoms which may result from a malperformance of the digestive function should be used as the material upon which the actual seat and nature of the fault should be diagnosed. To some minds so satisfying is the word "functional" that its application to a morbid state is considered to absolve the user from all further responsibility of seeking out the underlying causal and associated conditions, and a "symptomatic treatment" is the logical sequence. For the intelligent appreciation of the symptoms of indigestion, to refer them to their cause and rightly to interpret the bearings of the symptoms to one another, require, to my mind, these qualifications: a knowledge of the normal anatomy and physiology, an experience of the symptoms themselves and the circumstances under which they occur, and a systematic and orderly conception of the subject whereby the investigation of any given case may be pursued. As a contribution towards providing the last the following remarks are offered.

Given, then, some defect in digestion, there require to be examined, (*a*) the conditions which have given rise to it (the so-called causes), and (*b*) the perversions of well-being which it in turn has determined. The former is often far to seek and may at the best, with the present means at our command, be but imperfectly obtained, so complex are the circumstances; for the latter accurate observation is essential. Though regarded separately, it is none the less true that they are overlapping aspects of a common problem towards the solution of which each contributes.

The causal relationships of indigestion are of the widest; the antecedent conditions are well nigh innumerable, but they may be conveniently grouped thus—

A. Dietetic errors, improprieties in the ingesta.—These are among the most frequent, as they are the most obvious, causes of dyspepsia. It is not necessary that the food should of itself depart from a physiological standard; perfectly normal articles of diet may be presented under conditions which render them indigestible. Thus there may be far too much taken or a wholly insufficient quantity to excite the digestive process, the former error being, in this

country at least, the more frequent. The excess or deficiency may extend to all the requisite alimentary principles or be confined to one of them; too much or too little fluid, for example, with meals may each be responsible for an impaired digestion. Or, again, certain ingredients may be so associated as to render them indigestible, whilst taken separately they are open to no objection; such, for instance, are starchy or proteid foods enveloped in fat, as met with in meat smothered in greasy sauces or hot buttered toast or pastry. Ices or iced beverages, perhaps harmless alone, may seriously interfere with the digestion of other substances taken with them. Or food may determine indigestion by being imperfectly cooked, by a too monotonous repetition or presentation in an unappetising form, thereby preventing rather than inducing the needful flow of saliva with such consequences as that brings about. Another and common cause of dyspepsia is irregularity in meals, upsetting thereby the rhythm of digestion, or, as when too quickly following one another, interfering with the gastric digestion in its progress. Nor must idiosyncrasy in respect to certain articles of diet easily digestible by the great majority be forgotten. These are possible circumstances in which suitable and fit food may become harmful. Not infrequently, however, the error consists in some element of the food being distinctly noxious. This condition is represented in its simplest form by articles of diet which contain a large proportion of material which is absolutely indigestible, for the digestion of which, that is, the solvent juices of the canal are incapable. Such are the husks, skins, and seeds of vegetable or fruits and many uncooked food stuffs. The ill effects of such bodies are mainly caused by the mechanical irritation they give rise to. More serious are the results which follow those ingesta which are more actively irritant or even toxic, such as mineral poisons or the more subtle agents developed in decomposing or tainted nitrogenous food. In estimating the results which follow one or other of these dietetic errors regard must be had to whether it be of occasional or habitual occurrence, and allowance has also to be made for the wonderful degree of tolerance which the human alimentary canal may acquire by habit.

B. Next to these immediate causes of an indigestion of external origin are those which arise in the body itself, and of these the simplest are: 1. *Imperfections in the performance of the various movements connected with digestion.* To insufficient mastication many a case of dyspepsia may be referred, and a habit of "bolting the food" is as frequently

responsible for this as are defects in the teeth ; whilst such causes as paralysis of the masticatory muscles or ankylosis of the temporo-maxillary joint are as obvious as they are exceptional. Disturbances of the normal peristalsis of the stomach and intestines however induced, whether by structural changes in the organs themselves or mal-innervation, are of common occurrence, sometimes accelerating the passage of the contents, at others delaying it, more especially perhaps in certain sections of the canal, but in any case interfering with the orderly and progressive sequence in the digestive stages which is so essential to the proper performance of the function. As regards the movements of the stomach proper there is reason to believe that they are capable of being aided in their effect upon the gastric contents by the movements of the diaphragm and even of the heart, which may together be sufficiently effective to compensate for the complete absence of the stomach peristalsis when that organ by adhesions or from other causes is incapable of acting.
2. Less obvious than these impairments of motility are the imperfections due to *faults in the composition and quantities of the digestive secretions*, although the growing practice of examining the stomach contents is doing something to provide more precise knowledge of this difficult subject. A deficiency of saliva, besides leading to failure in the amyloid digestion is indirectly harmful by removing one of the normal stimuli to gastric secretion, whilst an excess in salivary flow diminishes the activity of the changes in the stomach. An over secretion of hydrochloric acid or a considerable deficiency of the same is regarded as of more frequent occurrence than errors in the quantity of pepsin that may be found. But from whatever cause it may arise gastric indigestion not only determines its own particular perversion of the entire digestive process, but also tends to occasion disturbance further on by submitting to the other fluids a chyme which is ill adapted to be acted on by them. Of the precise effects of abnormalties in these later fluids—the bile, the pancreatic and intestinal juices—our knowledge is far from satisfactory, but we do know sufficient to be able to affirm that errors in their composition or quantity are followed by some fault in the normal intestinal changes. The problem to be solved is how to distinguish the indigestion primarily resulting from their shortcomings from that which is purely gastric in origin.
3. A third group of conditions liable to determine maldigestion are those brought about by *bacterial action in the gastro-intestinal contents.* In health the changes induced by these micro-organisms, which may be regarded as normal

inhabitants of the canal, are accessory to and in some degree an aid to the regular chemical processes carried out by the secretions, although they are scarcely to be regarded as absolutely essential. But it may be easily seen that whether from the ingestion of toxic organisms or from the perverted action of those which are under ordinary circumstances harmless (such, for instance, as their having to deal with material of an unusual character) poisonous substances may be formed and indigestion set up. 4. Another source of disturbance in the process of digestion is connected with a function of the alimentary mucous membrane and its glands, which is too often overlooked. It is forgotten that this membrane has besides its extensive secretory capacities a duty to discharge as a channel of *excretion*. Little is accurately known of this it is true, and it is probably when there is some general morbid state existing, such as fever, that this property of the mucous membrane is best appreciated. In this respect, as, indeed, in many others, the membrane may be compared with the skin, the eliminative powers of which even of products of intestinal fermentation are well known, as are also the results of their arrest. There is also good reason for believing that the accumulation of gases found in the stomach and intestine owe their origin in part to direct transfusion from the blood, especially when rapid distension takes place after the removal of ascitic fluid in hysteria and cardio-pulmonary disease. 5. Ordinarily the products of digestion as they become diffusible are absorbed from the stomach and still more from the small intestine into the blood and lymphatic currents, and not only the digesta but also the greater part of the many pints of the various secretions that are daily passed into the canal. It may not unreasonably be surmised that the gradual removal of these materials facilitates the necessary changes in that which still remains in the tube and that a failure in their absorption interferes with the normal course of digestion. In this way, then, such conditions as may *interfere with absorption*, a function quite distinct from that of digestion, may become the cause of a very considerable dyspepsia.

Having thus indicated *seriatim* the various directions from which digestion may be immediately interfered with, it must not be supposed that each acts alone, for seldom can such be the case. Far more frequently the causal or precedent conditions are a complex the factors of which interact in the production of each other as they also do in bringing about the diseased state. In order, however, to arrive at a more comprehensive conception of the causal relationships of indigestion

it is desirable to consider these various groups of preceding and associated conditions from other points of view, such as how or by what means do they bring about their ill effects and to what more remote state or states may they in turn be referred. It is clear that, given one or other of these determining conditions of indigestion, it may act by irritation or injury of the structures concerned, that is the alimentary canal and its glands, leading to perverted action on their part; or its effect may be mainly, if not entirely, upon the material in the stomach or intestines which is undergoing digestion interfering therewith and having little or no effect upon the organs themselves; or it may be that the given cause acts in both of these directions. It is to the second of these, when the process is disturbed without any associated abnormality of the organs, that the term "functional dyspepsia" is alone permissible, if it be permissible at all. The ingesta, including therein the micro-organisms which gain entrance to the canal, are provocative of dyspepsia either by any direct unfavourable action they may exert upon the canal in virtue of irritant or toxic properties they may possess, and by setting up vascular, catarrhal, or even more serious inflammatory lesions lead to an impaired motility or perverted secretory action and thus determine an indigestion; or the same result may be reached by a direct interference by the ingesta, owing to its bulk or specific character, with the chemical processes carried on by normal secretions in a healthy canal, or the two modes of perverted action may combine in producing the morbid state. Disturbances of motility produce effects by prejudicially affecting the character of the digesting foodstuffs, interfering with their mechanical disintegration and the necessary admixture with the secretions, or by delay in propulsion favouring abnormal decompositions by the fluids or by organisms, a condition well exemplified in a dilated stomach or in a chronic constipation. It is to this cause also that sensory-motor symptoms such as colic are to be referred. Errors in the quantity or quality of one or more of the several digestive fluids, or perversions of the excretory function of the mucous membrane causing an escape into the canal of noxious bodies, or interference with the due absorption of the digested products, will act as causes of indigestion by disturbing the proper chemical changes in the canal, giving rise maybe to toxic substances which in turn react upon the mucous membrane and glands either directly or after absorption, thus establishing a vicious circle. Directly or indirectly, sooner or later, however apparently

diverse the causes may be, the resultant is perversion of the chemical process to which, as will be seen, the manifold symptoms which may occur are to be referred.

Passing now to consider how these groups of causes may themselves beseverally induced, the ingesta may be at once dismissed and attention directed to those which arise within the body itself. Of these undoubtedly the most important are the errors in quantity or quality of the secretions. It has already been stated that our knowledge of this subject leaves much to be desired, and beyond the saliva and gastric juice we assume rather than know. But at least we can recognise two separate sorts of conditions which may determine such errors. The most obvious are primary structural defects in the organs concerned, whether these be of a temporary and transient character such as vascular states of congestion or hyperæmia and the milder inflammatory lesions, or those of a more permanent character, such as degenerations, fatty, lardaceous, and the like, or definite new growths; or such accidental complications as the blockage of the bile or pancreatic ducts by a calculus. The interference with the proper secretion of the various juices which such lesions may cause is apparent, and not less obvious is their harmful effect on the movements of the canal, on the excreting functions of the mucous membrane with its glands, and on the due absorption of the digested materials. It is going outside my present limits to discuss the etiology of these structural changes, though it must be remembered that some at least are induced by those dietetic errors which have already been referred to as causes of indigestion. More obscure, and perhaps on that account more interesting, are the morbid states of organs and functions apart from the digestive tract which give rise among other symptoms to some of a dyspeptic character. Foremost among these remote causes are those which may be classified as "nervous." Concerning the innervation of the gastro-intestinal musculature we have a certain knowledge both as to the share taken therein by the vagus and sympathetic respectively, and our information on the nervous supply and function of the salivary glands is as precise as any that we possess concerning secretion; beyond that much cannot be claimed. It would not be difficult, however, to adduce examples of indigestion which are clearly attributable to nervous states causing a disturbed peristalsis and a perverted secretion or both; the nausea, vomiting, diarrhœa, and even gastro-intestinal pain which may result from violent emotional states are well known, and closely similar to such a centrally acting cause are those

more numerous reflexly induced by such as ovarian and uterine diseases, renal or biliary calculus, &c. An excellent example of a dyspepsia of reflex origin is to be found in the indigestion so frequently accompanying phthisis quite apart from that due to an associated structural disease of the stomach and intestines. The explanation of the pathology of the condition we owe to the admirable work of Dr. Head,[1] who has shown that both during the very earliest stage before there are any marked signs in the lungs, and also during the stage of gradual invasion of the tuberculous disease, there are attacks of referred pain and superficial tenderness over the mid-dorsal areas, as well as bi-temporal headache and tenderness of the scalp. These sensory phenomena are liable to ensue "when the bases of the lungs become affected with disease of a certain type. But these areas from the sixth to the ninth dorsal stand in close relation with the stomach, especially those on the left side. These two organs, the bases of the lungs, and the stomach send sensory impulses into the same segment of the central nervous system; an affection of the one which causes referred pain and superficial tenderness tends to cause a reflex disturbance in the other organ that refers into the same areas." Hence the liability of symptoms referable to the gastro-intestinal tract when fresh outbursts in the lung have set up pain and tenderness in the areas mentioned. Such symptoms are nausea, loss of appetite, and even vomiting. "The tongue is at first quite unaltered, the bowels remain regular, and the evacuations are unchanged in character; the pain is not increased by food, and vomiting does not necessarily relieve the pain and headache. On the other hand, anything which relieves the pain and headache will remove the nausea and vomiting." The dyspepsia of the latest stages of phthisis, which "is rarely accompanied by referred pain and superficial tenderness, is mainly characterised by flatulence, eructations, and signs of dilatation of the stomach and feeble motor and sensory activity, accompanied by marked signs of organic change in the walls and mucous membrane of the stomach." Whilst we may have some notion of how a peripheral nervous impulse may reflexly inhibit or stimulate gastro-intestinal peristalsis, we have no knowledge of the paths taken by such impulses as determine the secretion of a gastric juice deficient in hydrochloric acid or containing a large excess of that ingredient such as undoubtedly occurs, and with every reason to believe

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[1] Brain, 1896.

through perverted innervation. Whilst it is conceivable that the necessary fluids may fall short in their normal character from a deficiency of materials from which they may be formed by the secreting glands it is doubtful if such really occurs. But at the same time there are good grounds for believing that in conditions where the general tissue metabolism is gravely impaired or the chief excretory organs seriously diseased the consequent throwing into the circulation of unusual or excessive products of waste supplies to the several digestive glands a blood from which vitiated secretions are prepared. It is probable for various reasons that the liver is particularly liable to suffer in this direction. The frequent association of gastro-intestinal complication with renal disease is well known, and there is some reason to believe that the indigestion of this state is in part at least due to a perverted excretory function of the alimentary mucous membrane determined by the disturbance of the kidney function with its consequent failure to eliminate the waste products.

To summarise what has been said as to the causal relationships of indigestion, it would seem that the immediately preceding and associated conditions are separable into six groups, two of which are of origin external to the body, whilst the others are internal; and that the latter are directly referable to primary structural defects of the digestive organs or to impaired innervation of the muscular and secretory apparatus centrally or reflexly induced. And that whatever may be the nature of the disturbing cause it produces its effects almost entirely by interfering with the chemical processes which take place in the alimentary canal. It is this latter circumstance that confers upon digestive disorders their peculiarity, serving to distinguish them from the diseases of other systems and suggesting also the lines upon which their treatment, at least, in great part, should be based. It is less the disorders of the organs involved than abnormal processes taking place in the material undergoing digestion that constitute the *fons et origo* of most indigestions, and we have nothing like that to deal with when considering the morbid states of other functions, when for the most part some structural change, obvious or obscure, underlies the abnormal manifestations.

Having now considered the relationship which indigestion exhibits towards precedent and associated states, let us turn to those aspects of the subject which deal with the effects upon the organism which the indigestion itself brings about, with the sequential results of which it is the cause or antecedent, as exhibited by what are known as the signs and

symptoms. The symptom complex which may attend any form of indigestion requires to be carefully unravelled ere the real relationships of the phenomena presented are satisfactorily understood and before a reasonable plan of treatment is formulated. To begin with there are the associated symptoms due, not primarily at least to the indigestion, but to the underlying cause of it and of them. Possibly no doubt the indigestion may tend to aggravate or modify these as they in turn may qualify the more strictly dyspeptic manifestations. Inasmuch also as the ultimate object of the digestive process is to supply the material for the tissue nutrition it may well be that among the remote results of an indigestion, especially if it be of any duration, the general nutrition should suffer. It is needful to differentiate the evidences of this from the dyspeptic symptoms proper. After making, however, due allowance for these there still remains a most extensive and varied range of departures from sound health of all degrees of severity which are distinctly to be ascribed to some flaw or other in the digestive process. The extreme diversity of these symptoms is one among other reasons which renders the investigation of the subject so difficult. But this very diversity is only what might reasonably be expected when the great extent of the organs is considered and the many and different phases of the digestive function is remembered. The widest and most abundant opportunity of disturbance exists in the natural condition of things, and the directions whence disturbance may arise being as numerous as they are a complicated and variable manifestation is the inevitable result. It will be convenient in the consideration of the symptoms and their bearings to adopt the distinction of *local* and *remote*, though it be in some respects an artificial arrangement and not capable of being strictly observed. By *local* symptoms is meant those which are obviously and directly connected with the digestive organs, and among the most constant are abnormal sensations. Inasmuch as the function should be performed without giving rise to any sensation after the food is swallowed it may be laid down that any conscious feeling in the course of the process is wrong. Frequently there is nothing beyond a sense of weight and oppression vaguely referred to the epigastrium or generally over the upper half of the abdomen, or this may amount to positive pain. Most variable and of uncertain significance is this symptom; strictly localised or widely diffused, relieved by pressure or acutely tender, stabbing, cutting and paroxysmal or continuous, are but some of the qualities by which it is marked. A nasty taste in the mouth with a

furred tongue and foul breath may be the frequent complaint of one patient, whilst another, equally a dyspeptic, finds no place for such in his category of ailments. Acidity and heartburn, nausea and vomiting, uncomfortable distension of the abdomen, flatulence and the passage of wind, gaseous eructations and belchings of an acid or bitter or tasteless fluid, diarrhœa or constipation, with possibly an impaired appetite, capricious or entirely wanting, and unhealthy stools of all variety of consistency, odour, colour, and appearance, complete a list the items of which in all degrees and combinations constitute the local symptoms of indigestion.

It is not my present purpose to discuss these phenomena in detail nor to indicate so far as may be possible their respective significance as diagnostic of the nature and seat of the determining fault; but referring to the two main conditions under which, as we have seen, the various exciting causes of indigestion may be grouped—viz., obvious structural disease of the organs and direct interference with the chemical processes taking place in the stomach and intestines—it is certainly the case that these local symptoms are present in a greater or less degree whatever may be the character of the cause, and in the more pronounced and graver structural lesions they may almost be regarded as paramount, the remoter manifestations being in the greater number of cases scarcely existent. The symptoms immediately resulting from an indigestion not connected with the alimentary canal or its glands, but with parts and regions remote therefrom, are both clinically and pathologically the most interesting phenomena connected with dyspepsia. Insomuch as many of these are induced by affections of other systems they are not diagnostic of indigestion, and their true value in the diagnosis thereof becomes proportionately more uncertain, requiring more careful weighing for their proper appreciation. They may be the grounds upon which the patient seeks advice, and the manner in which they may be presented is often such as not to suggest, at least in the first instance, a digestive disturbance as being at the root of the matter. Since also they may and frequently do occur without any pronounced symptoms more obviously referable to the digestive organs the difficulty of diagnosis becomes the greater, and not seldom the condition may be regarded as one of primary nervous cardiac or pulmonary disease the relation to an underlying indigestion being so obscure.

Prominent among the *remote* manifestations are those which may be comprehensively designated "nervous," and

of these headache is perhaps the most frequent in occurrence, as in turn indigestion is probably the commonest cause of headache. As regards locality, whether generally diffused or localised to the frontal, vertical, temporal, parietal, or occipital regions, the time of its occurrence in relation to food, its characters—so far as words can describe it—dull, aching, throbbing, &c., nothing specifically characteristic can be affirmed—nothing, that is to say, which can at once enable a given headache to be set down as dyspeptic in origin however probable such may be the case. Once, however, its cause can be so defined some significance may be attached to these several features as helping to indicate the special factor or factors of digestion which may be at fault. But inasmuch as the laborious researches of Dr. Head have shown that these areas of pain with their associated areas of scalp tenderness are primarily at least to be regarded in connexion with corresponding regions of pain and tenderness over the trunk rather than with the thoracic and abdominal viscera which may be at fault, the diagnostic value of headache in respect to dyspepsia becomes somewhat diminished. None the less, as symptoms of indigestion, headache, and hyperalgesia are amongst the most frequent, whilst the absence of tenderness, though the pain may be excruciating, distinguishes the true megrim from the bilious, sick, or dyspeptic headache. Scarcely less frequent than the foregoing, and often extremely distressing, are giddiness and vertigo. Subjective affections of sight, such as amblyopia, coloured flashes of light, muscæ volitantes, &c., or of hearing, such as tinnitus aurium, are also of no unusual occurrence in dyspepsia. The association of drowsiness with indigestion is generally familiar, but the connexion of wakefulness with the same state is not perhaps so well-known. The condition of irritability, of temper, contrasting so strongly as it does with the sense of comfort and placid well-being that attends a good digestion, is closely simulated in the course of still more remote disturbances of nutrition to which undoubtedly dyspepsia contributes to the development of, although it is here sought to distinguish between the symptoms for which indigestion is distinctly responsible from those due to the later metabolic change in the tissues which are really different from the true digestive processes. Attacks of mental depression amounting to actual hypochondriasis and melancholia with delusions of suspicion are well recognised as of frequent dependence on imperfections in digestion ; the very name melancholia, a term of Hippocratic medicine, signifies the connexion. It has also been made clear that outbursts of mania or other psychic disturb-

ances in those whose mental powers are perturbed are not infrequently traced to failures in the digestive process, especially if there be constipation. A close relationship between that condition of deficient nerve power known as neurasthenia and disorders of digestion has been described, although here again the general deterioration of nervous energy may more immediately be the expression of an impaired nutrition of which a dyspepsia may be but one factor in the production. Corresponding in some measure to neurasthenia of dyspeptic origin is a general sense of lassitude and muscular weakness of like cause, though partly due in all probability to an inadequate removal of the results of an abnormal tissue metabolism ; and the same may be said for those violent cramps, more especially of the muscles of the calf, which not infrequently result from dietetic or digestive errors. Pains in the back and in the limbs, usually of a dull aching character, the former sometimes due to a loaded colon, and therefore more properly to be reckoned among the local symptoms, are commonly complained of, or a pain about the right shoulder so frequently associated with hepatic trouble and to that extent a possible accompaniment of indigestion.

Among the disturbances of the circulatory function attributable to a disordered digestion may be mentioned palpitation and all degrees of cardiac irregularity up to complete intermittence or even fainting and pains over the region of the heart often closely simulating angina. The displacement of the organ by flatulent distension of the stomach or intestines may interfere with its action ; but this is not the only way in which indigestion disturbs the heart. The effects exhibited by the peripheral circulation are not less marked. as witness the flushing of the face so often following a meal even free from alcohol and of the simplest character. The coldness of the extremities is another phenomenon of the same class. Respiratory defects are much less commonly observed, though the so-called "stomach cough" is among the symptoms appreciated by the laity. Whilst doubtless an expression of gastric or gastro-intestinal irritation, it does not usually accompany the more definite evidences of indigestion. A true dyspeptic dyspnœa is less well known, but of its existence there is little doubt both with other dyspeptic symptoms or so predominating as to obscure its real origin. Along with a sense of oppression and impeded breathing is a constant desire to take a deep inspiration occurring in attacks often of some hours' duration and not infrequently at night—a condition which recalls in its description an asthmatic paroxysm as provocative of which indigestion also takes a high place.

A connexion between indigestion and affections of the skin has long been recognised, although different opinions have been held as to the degree of the relationship. For whilst it is very certain that an eruption of urticarial wheals, of erythema, of pruritus, or even of eczema or acne rosacea, to mention only those cutaneous affections of most frequent occurrence, may follow the ingestion of certain articles of diet, just as these and other rashes may be caused by various drugs, the actual conditions of their development is apt to be most uncertain. Not only are such results met with in but few individuals and are of nothing like universal occurrence, but they are not constant even in the same individual, and they may or may not be accompanied by definite dyspeptic symptoms, such as pain, vomiting, diarrhœa, &c. Setting aside for the moment the question of how such eruptions are produced, it is doubtful whether they can be regarded as results of indigestion, and whether they are not rather to be considered as caused by the direct toxic action of certain ingredients contained in the articles of food with which the process of digestion is not strictly concerned. Sometimes there is good reason to believe that coincident with the cutaneous urticaria or eczema similar if not identical conditions are developed in the alimentary mucous membrane, and in such cases evidences of a perturbed digestion are of course likely to be manifested. The long-continued ingestion of certain articles of diet, such, for instance, as alcohol, may, by the injurious effect it exerts in the nutrition of the tissues, tend to produce certain skin affections, but such are not to be regarded as true dyspeptic phenomena, from which indeed they are really remote; rather are they true skin diseases predisposed to by the malnutrition which improper feeding or imperfect digestion have determined and immediately induced by some locally exciting cause. It is on the whole probable that the relationship of skin affections to dyspepsia is not so close as was formerly supposed, and that in most cases the element of idiosyncrasy has to be considered—a circumstance that would go far to shift the responsibility for any given eruption to the cutaneous structures themselves or their trophic governance rather than to place it upon a disordered digestion. The evidences of indigestion manifested in the urine are seldom the cause of actual discomfort to the patient, and beyond the familiar deposit of urates usually require an elaborate analysis for their detection, whilst as yet the significance of the abnormalities thus observed is only very vaguely understood. Even the precipitate of lithates, as well as of phosphates and

oxalates, which may accompany very definite dyspeptic conditions are probably expressions of later metabolic perversions rather than of direct imperfections of digestion. It is very certain, however, that the process of digestion even in health does exercise a very real effect upon the character and composition of the urine as witness the increased alkalinity after meals and the variations in the amount of the nitrogenous constituents, urea, uric acid, and creatinine, with a full or diminished diet, although such bodies as these are only remotely connected with digestion and are products of tissue waste. The kidney as an excretory organ is concerned with the elimination of some of the results of intestinal putrefaction which are absorbed into the blood in place of being voided with the bowel evacuations. The most important of these substances are the aromatic sulphates and albumoses. The former are compounds of such bodies as indol and skatol with sulphuric or glycuronic acid and alkalies, especially potash. These bodies known as chromogens are themselves colourless though readily giving rise to pigments on the addition of acids They are mainly, if not entirely, originally derived from the intestine, and their presence in excess may be regarded as an index of undue intestinal putrefaction. It has been proposed to ascertain the point at which excess is reached by considering the ratio of the ethereal to the so-called "preformed" sulphates or neutral salts of the alkalies, but the exact significance of their presence beyond the general fact I have mentioned I am unable to say. The existence of albumosuria or the very exceptional occurrence of peptonuria are indicative of a certain degree of proteid digestion, the products of which have been absorbed into the blood, and in virtue of their toxic properties have induced an irritation of the kidney and thus led to their excretion. But it by no means follows that this digestive process has taken place in the alimentary canal, for the albumins of the tissues may be so dealt with by microbic invasion. Even when their source may with reason be assumed to be the gastro-intestinal tract, their presence in the urine may not necessarily depend upon an error in digestion so much as some imperfection in the process of absorption from the mucous surface of the bowel. Glycosuria, oxaluria, and phosphaturia are probably but indirectly symptomatic of mal-digestion, whilst their relation to tissue metabolism is unquestioned. On the whole it may be said that the urinary abnormalities immediately due to dyspepsia are few, and interesting as they may be, and valuable as is their promise, they cannot at present be said to count for much in the actual diagnosis of indigestion, far

less to afford any indication of the precise nature of the digestive flaw.

In seeking to explain these exceedingly diverse and widespread results of an imperfect digestion it becomes necessary to consider the structural relations of the alimentary tract with the other organs of the body and thereby to trace the functional relationships which these remote symptoms express. By two distinct structures is this connexion established—the nervous and the vascular. The blood-supply to the alimentary organs is most extensive, so much so that at any moment a third of the total quantity of the blood of the body is contained in their vessels. This amount is easily capable of great increase by conditions of central or reflex origin which lead to paralysis of the splanchnic area. The direct arterial supply from the aorta possesses—at least, as far as the stomach and intestines are concerned—a most complete series of anastomoses sufficient to compensate for any arrest or obstruction to the circulation in any one part; and this direct supply *viâ* the cœliac axis and inferior mesenteric vessels is further supplemented by a most elaborate system of post-peritoneal communications between the visceral and parietal branches of the aorta sufficient, as has been shown, efficiently to carry on the circulation even when the main gastro-intestinal trunks have been obliterated. Even more extensive are the arrangements for the venous return, and although there is interposed an obstruction to the gastro-intestinal flow in the shape of the hepatic portal circulation, this is in part counteracted by the free communications between the gastric and mesenteric veins with the œsophageal and inferior hæmorrhoidal as well as the sub-peritoneal parietal venules. Accessory to this venous drainage, and also concerned in removing the digested products is the lymphatic system of vessels and glands. Our knowledge of the innervation of the digestive organs is in some particulars admittedly inexact. Fibres from both the cerebro-spinal and sympathetic systems are distributed to the various structures and in some cases have been traced to an intimate connexion with the muscular and glandular elements, but concerning the paths taken by many of the afferent impulses information is much to be desired. Enough is known, however, to enable us to recognise generally the connexion of the alimentary organs with the nerve centres and thus to appreciate the reflex and referred phenomena induced in other systems. So extensive and intimate a neuro-vascular connexion with other organs of the body at least indicates the possibility of

remote symptoms being induced by digestive disturbances, suggests the channels by which they may be developed, and permits us to regard these disturbances as being in the nature of irritants to those distant parts, such irritation acting either on the nerve terminals in the digestive tract and so reflexly affecting the functional manifestations of other organs, or by the direct transference by the blood and lymph currents to these structures of toxic material absorbed from the gastro-intestinal canal. By whichever of these routes the remote organs become secondarily affected there appear to be two conceivable methods in which they may be disturbed—either by the direct interference with the normal activities of their protoplasmic elements, or by some modification of the blood-pressure in their vessels. That either of these methods is possible must, I think, be admitted, but proof of any one of them is at present wanting. But inasmuch as toxins are known to be formed in the alimentary canal under conditions of mal-digestion and the injection of bodies possessing poisonous properties into the blood current is well known to lead to the production of symptoms characteristic of the poison, it would seem highly probable, to say the least of it, that noxious substances absorbed from the intestine would equally determine morbid symptoms in distant parts. Doubtless to a very great extent the organism is protected against the enterogenetic poisons, and it may be—at least, in the majority of cases—that some impairment of the integrity of the intestinal mucous membrane is necessary to permit the absorption of the toxins, and this might be such as the poisons would themselves inflict on the epithelial cells. Whether when absorbed into the circulating medium these substances produce their effect directly on the tissues or indirectly upon them *viâ* the nervous system there is little or no evidence to show, merely surmise; but whether by either or both means such poisons would seem adequate to explain most if not all the remote symptoms which are properly referable to indigestion. That peripheral irritation of gastro-intestinal origin might of itself be sufficient to induce distal symptoms without the absorption of any harmful material appears possible, for the presence of intestinal worms has been known to produce such results. As to the other suggested explanation for some of the distal symptoms—viz., that they are due to variations in blood pressure reflexly induced by gastro-intestinal states—very little can be said. Such symptoms as giddiness, vertigo, and even some dyspeptic headaches, may be thus explained, and some grounds for this may be found in the circumstance that some of these phenomena may immediately disappear after action of the bowels—a circumstance that is always

attended with a fall of blood-pressure as constipation is accompanied by the reverse. The relief from headache may follow so quickly as almost to negative the idea that the emptying the bowel has simply produced the effect by getting rid of toxic material.

Mention has already been made of the fact that definite structural lesions of the alimentary tract, however marked may be the local symptoms, are frequently wanting in any special evidences of perturbed function in other organs except in so far as they may share in the general malnutrition which the change engenders. Conversely it may be said that whilst disturbances in the chemical processes taking place in the stomach and intestines may, and usually do, give rise to local symptoms it is pre-eminently in connexion with these immediate digestive imperfections that the remoter manifestations are likely to occur and may indeed be the sole evidences. This distinction if true would be of distinct value for diagnostic purposes, and my experience leads me to believe it to be of some value in this direction.

Among the many features of dyspepsia that call for comment the uncertainty of its manifestations is as well known as it is remarkable. How commonly is it the case that a patient—the subject may be of frequent indigestion—consumes with impunity a meal that violates in quantity or quality most of the dietetic rules he has been accustomed to observe and has found almost essential to his well-being. What is one man's meat is another man's poison all are familiar with, and even how often the food which is suitable to-day may disagree to-morrow or the plainest fare may provoke an indigestion. The fact that what are called errors in diet do not of necessity induce discomfort, local or remote, and with many people rarely, if ever, lead to indigestion, would seem to suggest that the *materies morbi* is less in the ingesta as presented than in the subsequent digestion processes, and is to a great extent independent of the actual food taken. It is to remedy this that the treatment should be directed, and, as I fully believe, often with more success than by elaborate dietetic rules.

Lastly, if we compare the precedent with the sequential relations of dyspepsia, we find on the one hand the causal conditions acting in most cases by inducing a perversion in the chemical processes with production of toxins and themselves determined by noxious ingesta or by motori-secretory perversions due to structural change in the digestive organs or far more often to a defective innervation; on the other hand are resulting symptoms the expressions of local perver-

sion of the digestive function or of the distant effects due to toxic absorption or reflex irritation.

My time, gentlemen, but not my subject, has reached its limits, and I am fully conscious that in the remarks I have made, or, perhaps, more particularly in the way I have treated my theme, that I have laid myself open to the charge of having expressed in too formal, too cut-and-dried a manner a subject which presents too much uncertainty and variety rightfully to admit of being so considered, and that I have aggravated my offence by saying nothing that is new. To the latter count I plead guilty at once, and can only urge in extenuation of the former that it is the want of some formal outline that appears to me to be responsible for some at least of the vagueness in which the subject is enveloped, and that what I have said, if it serve no other purpose, affords a basis for criticism and probable improvement. It is possible, of course, that my method tends to strain relationships and to overlook much that is important for the sake of uniformity, but, at the same time, it allows us to formulate what we do know and to indicate the directions in which we are ignorant, whilst I believe the suggestions I have offered to be more comprehensive than the groupings of dyspepsia which are commonly put forward. However lofty be the platform from which the superior mind unfettered by formality surveys the efforts of the systematic observer, there are many, I believe, who would be helped by some guide, imperfect though it be, in the labyrinth of morbid phenomena involved in "dyspepsia," and in that belief I have submitted to your appreciation the foregoing remarks as embodying the considerations which, in my judgment, are essentially preliminary to the formation of a diagnosis, and, therefore, to the rational treatment of any case of indigestion.

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